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Federation of Transit Agencies as a Solution for Service Integration

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Abstract
Inadequate organization of public transport services in urban areas, particularly in the large ones, is one of the major reasons for the unsatisfactory level of service and economic problems of the operating companies. Despite the current trend toward mergers of transit operators into large public agencies, the services in most cities remain fragmented in various degrees; integration is often not in sight due to organizational problems which appear insurmountable. Losses to the users, various degrees; integration is often not in sight due to organization.

This article briefly analyzes the reasons for this situation, explores its consequences and their importance. A number of solutions for the problem are possible, but none of them is simple and easy to achieve. The federation of transit organizations introduced recently in Hamburg, Germany, has proved to be so successful that it has received wide attention in international professional circles. This solution therefore deserves a careful study by transit operators as well as government officials of metropolitan areas in this country.

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Federation of Transit Agencies as a Solution for Service Integration

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INADEQUATE organization of public transport services in urban areas, particularly in the large ones, is one of the major reasons for the unsatisfactory level of service and economic problems of the operating companies. Despite the current trend toward mergers of transit operators into large public agencies, the services in most cities remain fragmented in various degrees; integration is often not in sight due to organizational problems which appear insurmountable. Losses to the users, the operators, and the city from this situation are often very significant.

This article briefly analyzes the reasons for this situation, explores its consequences and their importance. A number of solutions for the problem are possible, but none of them is simple and easy to achieve. The federation of transit organizations introduced recently in Hamburg, Germany, has proved to be so successful that it has

The authors gratefully acknowledge the cooperation of Dr.-Ing. Fritz Pampel, member of the Directorate of HVV, Hamburg, in providing information and personal explanations during the preparation of this article.

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PROBLEM OF ORGANIZATION IN URBAN PUBLIC TRANSPORTATION

Since World War II there has been a major shift of urban public transportation systems to public ownership. By 1968, about 69 percent of all transit passengers in the United States were carried on 114 publicly owned systems, while 980 private, generally much smaller companies (comprising 90 percent of all carriers) handled the remaining 31 percent of the traffic [1].* The new public agencies reduce that total number of operators somewhat as they purchase not only the major systems but also several smaller ones within the area. Yet, as will be shown later, in some metropolitan areas many small operators have remained in business.

The Problem. Lack of integration among transit systems has very serious consequences. While the passengers are most directly affected, the operators also incur losses from inefficiencies; ultimately, the whole urban society suffers indirectly but significantly from such conditions.

Passengers suffer from higher fares caused by separate payments to each individual company; travel time is often greater than it could be in an integrated system which would allow the choice of the fastest available route; unnecessary transfers, lack of information about services, etc., represent a further inconvenience and loss to the passengers. These factors are often sufficient to make the passenger switch to other modes of travel or avoid making a trip.

Operators may have the problem of serving competitive routes, each of them having a lower patronage and often a more uneven loading of vehicles than a consolidated service would produce. Such overlapping services are maintained either because without them other parts of networks would also lose traffic, or merely because a regulatory authority demands it. Operating inefficiencies may also derive from the use of modes which are not optimal but appeal to a small portion of the total transit market. Examples are buses paralleling rail lines (Lindenwold, New Jersey–Philadelphia) or special services competing with regular lines (jitneys skimming the cream of the traffic on Mission Street in San Francisco).

* Numbers in square brackets refer to the References at the end of this article.

Finally, inefficiencies in transit services incur losses to the city and urban society in general since they reduce mobility of the population and create additional pressure on the highway system.

Examples of the Problem. Experience of transit consolidation into public agencies has been quite varied, ranging from the successful consolidations in Pittsburgh and St. Louis, where the new public authorities acquired 33 and 15 private companies, respectively, to New York and Boston, where, after several mergers, more than 30 separate transit operators remain.

The New York situation represents a typical example of the lack of transit coordination in the United States. About forty different "subsystems" can be identified, nearly all of which operate independently of each other. Some of them are not even internally integrated: the New York City Transit Authority (NYCTA) took over the large holdings of the Fifth Avenue Coach Corporation in 1962, but has had to operate them as a wholly owned subsidiary—the Manhattan and Bronx Surface Transportation Authority (MABSTOA)— ever since. The passenger sees three different major networks with no apparent connection and with different sets of rules: the NYCTA rapid transit network permits free transfers at all possible points within its system; its surface bus network issues such transfers at 2,164 out of 6,054 possible connections (there being no consistent pattern which determines the permitted and refused situations [2]); MABSTOA does not issue any interroute transfers at all. Finally, there are no transfer arrangements between the three networks.

Since the creation of the Metropolitan Transportation Authority, which took over both the NYCTA and the Long Island Rail Road (LIRR), one might have expected considerable change. However, no major results have yet appeared, except for the joint planning of a new tunnel under the East River and a shared right-of-way in Queens. Fare systems remain different, no plans for rationalization and possible merging of routes have yet been announced, and there has been no reduction in the number of quite large private companies operating feeder and some trunk line service to both NYCTA and LIRR.

In Los Angeles, the main transit system—the publicly owned Southern California Rapid Transit District (SCRTD)—was formed through merger of two large and several small predecessors. How-

ever, 14 smaller companies continue to operate in the principal SCRTD territory, including seven owned by municipalities. The Chicago Transit Authority has exclusive operating rights within its territory; however, this encompasses only a portion of the contiguous urbanized area, in the remainder of which a dozen small companies ply their trade. Similarly, in Boston the central city is served by a public agency, while old private companies survive, and some new ones even appear, in the suburbs. In Philadelphia, the principal variation is the existence of a separate public agency for the new rapid transit line to Lindenwold, N.J., in addition to the major public transit carrier, Southeastern Pennsylvania Transportation Authority (SEPTA).

In the San Francisco region, the Bay Area Rapid Transit (BART) system has been designed to be fed by surface lines of two major, publicly owned carriers, without which the usefulness of the BART may be seriously impaired. However, the three agencies are far from agreeing on coordination of fares and schedules, and on location of feeder routes, even after a complex research study into these questions.

A special problem arises where Class I railroads provide suburban commuter services. For institutional reasons they remained remote from urban agencies until rather recently, when they began to accept some government subsidies to improve urban passenger operations. The contracts between SEPTA and the two railroads serving Philadelphia are perhaps the most advanced examples to date of the inclusion of railroad commuter service in the urban transit framework, but even this coordination is limited.

An analysis of transit organizations in the 12 largest metropolitan areas of the United States, summarized in Table I, shows that 11 now have public ownership of the major network, but that in only two of them has consolidation been substantially achieved through purchases of the small private carriers as well as the major ones. Elsewhere, there is no discernible trend toward absorption of the private transit companies into the major public agency.[1]

The Causes. The numerous reasons for the current situation can be classified as historic, political-legal, and organizational. The

1. For a rather comprehensive review of regional organizations in public transportation in different countries see Lehner [3] and Mross [4].

historic causes include a basic belief in private enterprise and only grudging acceptance of public ownership where this is necessitated by the unwillingness of private entrepreneurs to continue operations

TABLE I—PUBLIC TRANSPORTATION AGENCIES IN 12 MAJOR U.S. METROPOLITAN AREAS*

	Number and Type of Agencies			
Metropolitan Area	*Total*	*Public*	*Private*	*Remarks and Explanations*
New York–Newark	39	RTS: 1 RT: 1 RR: 1 S: 1	RTS: 1 RT: 1 RR: 3 S: 30	LIRR, NYCTA, and MABSTOA counted separately. New Haven RR included with Penn Central. Private RTS carrier is predominantly a bus operator, but also operates "Newark Subway." Private surface operators include nine "Bus Owners' Associations" in New Jersey, comprising about 145 individual owners.
Los Angeles	15	S: 8	S: 7	
Chicago	22	RTS: 1	RR: 9 S: 12	Seven railroads provide significant services, two are minor.—A limited transfer validation plan between CTA and IC introduced in 1969.
Philadelphia	12	RTS: 1 RT: 1	RR: 2 S: 8	RTS agency sponsors RR and some bus services. Some coordination exists; work on further improvements under way.—Some 12 minor private bus operators also exist in the Region.
Detroit	6	S: 1	RR: 1 S: 4	Railroad service is minor.
Boston	33	RTS: 1	RR: 2 S: 30	New Haven RR included with Penn Central.
San Francisco	16	RT: 1 S: 3 P: 1	RR: 1 S: 10	RT service commences in 1971. "P" agency may become a "surface" operator. One surface system operated by a Jitney Bus Owners' Association.
Washington	7	RT: 1	RR: 2 S: 4	Railroad service is very minor. "RT" agency is constructing system to be operational in 1973.
Pittsburgh	3	S: 1	RR: 2	Railroad service is very minor.
St. Louis	2	S: 1	S: 1	
Cleveland	5	RTS: 1 RT: 1 S: 1	S: 2	
Baltimore	8	S: 1 P: 1	S: 6	

NOTES: P: Agencies presently planning only, but with powers to become operators.
RT: Agencies operating rapid transit systems only.
RTS: Agencies operating rapid and surface transit systems.
RR: Agencies operating railroad commuter service.
S: Agencies operating surface transit systems only.

* Information from *Metropolitan Directory 1969–70*, Bobit Publishing Co., and a number of other sources. Some figures are approximate.

of an unprofitable industry. Rather than accept the cogent arguments which can be made for exclusive publicly owned systems in such situations, this attitude often results in fostering private ownership where a profit can still be made—suburban service beyond the traditional "flat fare" area, charter and contractual school services —and restricting the public agency to the basic operations which are often economically least attractive.[2]

These attitudes are reflected in the political arena by laws limiting the public agency to certain territories or types of service. Thus, for example, the Chicago Transit Authority can operate exclusively only in the city limits of Chicago and, while it is not prohibited from serving areas beyond, it has to compete in the suburbs with smaller private carriers. The enabling acts of many other public transit agencies do not provide for any exclusive territorial rights at all. Charter service, the only transit operation guaranteed to be profitable, is legally denied to some public carriers as, for example, SCRTD in Los Angeles, so that private bus operators can remain active in this field of endeavor, without obligations for other services.

Political problems also arise in connection with government boundaries. Most metropolitan areas are divided into a number of counties and municipalities, and often spread over two or three states. Public ownership of mass transit systems is then most readily achieved by means of a special governmental authority or district, but the establishment of such a body can be complex. As the examples of New York, Los Angeles, and San Francisco show, even a regional public body will still find other publicly owned systems within its territory.

Typifying the organizational barriers to consolidation is the area of labor problems. Mergers of union locals may be resisted; there may be a roadblock to establishing new seniority lists, or to adjusting pension plans. Officials of the NYCTA will long bear the scars of the disputes which occurred during the merger of the IND and BMT Divisions of their subway system. Other organizational problems arise in relation to nontransit activities of some carriers, such as the railroads and intercity bus companies.

Possible Solutions. It is obvious from the preceding discussion that the need for a better solution of transit organization is great. It is

2. An informative analysis of different types of transit organizations is given in [8].

equally obvious, however, that solutions are not easy to achieve. While society as a whole would benefit from integrated transit services, interests of some groups within it may be hurt. Some users may, for example, face higher fares as tariffs are unified or transit networks pruned to make them more efficient. Some private carriers may lose part of their profits or perhaps their entire business if the solution includes mergers or realignment of service territories. The functions of regulatory agencies, the political power which accompanies the award of franchises by city councils, and the domains of some civil service systems might all be diminished. Many a possible solution has been abandoned or not seriously considered because one or another of these problems has proved to be insurmountable.

Possible forms of organizations coordinating transit operations within an urban area range from minor agreements among two or more operators on joint tariffs to outright mergers. Pampel [5] lists the following forms:

Tariff Associations, limited to contracts on joint tariffs and the distribution of jointly collected revenues. Suitability is limited to situations where the partners do not compete with each other and have no overlapping territories, but usually end-to-end connections. An example in interurban transport is the airline industry, in which a passenger can purchase a single ticket covering several flight segments on the aircraft of different companies without paying any penalty for using more than one airline.

Transit Communities, which not only bind themselves to a common tariff but coordinate routes and schedules and, if appropriate, pool or exchange some of their rolling stock. The U.S. railroads have long operated under such an arrangement.

Transit Federations, which establish a formal federated agency and delegate to it certain powers related to planning, tariffs, revenue distribution, etc. An example of this type of arrangement, in Hamburg, will be discussed below.

Mergers, in which portions of companies or entire companies are merged with others, either operating as subsidiaries or losing their identity altogether.

In the United States mergers have been the dominant approach to coordination of transit systems, and, as already mentioned, have had varying degrees of success. There are a few tariff associations, perhaps one or two transit communities, but no transit federation.

This concept is so new, having been applied first in Hamburg in 1965, that its usefulness in solving transit problems of United States metropolitan areas has yet to be explored. A detailed description of the Hamburg Transit Federation is therefore appropriate here.

THE HAMBURG TRANSIT FEDERATION—HVV

Hamburg, Germany's second largest city (after Berlin) and its largest port, is located on the Elbe River in Northern Germany. The geographic location, its status of a city-state, and its harbor give it a key position in the national transportation networks of all modes, and a character of a diversified city with extensive trading, industrial, administrative, and cultural activities. The City-State of Hamburg has a population of 1.8 million and an area of 290 square miles, average density being 6,200 persons per square mile. Population of the metropolitan area is approximately 2.4 million.

The Background. Transportation developments in Hamburg since World War II have been characterized by two significant factors: the city has been pursuing a well-defined, coordinated transportation policy; and, in accordance with the policy, major investments have been made in improvements of existing facilities and construction of new facilities of all modes [9].

Transportation policy has been based on the premise that both major sectors of transportation—public and private—have important roles and must be adequately provided for. Consequently, major improvements must be made to both systems. The highway and street system has been improved in all aspects, but the number of vehicles in the city center is controlled by parking supply and rates. The rate structure favors short-term parkers, and rather drastically penalizes long-term parkers. Based on recommendations of a study of alternative systems and technologies, conducted in the 1950's, major investments were made in construction and improvement of the rail rapid transit system, with buses (gradually replacing streetcars) as feeders to it. Construction of the ways (tunnels, embankments, etc.) is financed by the city. The operating company provides the track as well as signaling and rolling stock.

With several recently opened lines, the rail rapid transit network (urban and suburban) presently has a length of 170 miles or 16 percent of the route length of all modes; it carries, however, 56 percent

of all public transport passengers and 66 percent of passenger miles.

The coordinated transportation policy leading to parallel, carefully planned improvements of both public and private systems has already shown good results. Transit riding has remained high despite rapid motorization. As Table II shows, during a 14-year period (1955–1968) degree of motorization (passenger cars/1,000 persons) in Hamburg increased more than five times; yet, during that period, transit riding decreased by only 23 percent. Since 1966 it has been stable.

TABLE II—MOTORIZATION AND TRANSIT USAGE IN HAMBURG—1955–1968

Year	*Pass. Cars/ 1,000 Persons*	*Index*	*Annual Rides/Capita**	*Index*
1955	42	100	211	100
1960	95	229	191	91
1965	174	417	167	79
1968	213	512	162	77

* Transit rides are for HHA (see text below) only. Data including all transit carriers are not available for earlier years. In 1968, annual rides per capita on all carriers amounted to 228.

Comparison of the Hamburg transportation system with others, particularly those in U.S. cities, is difficult due to the differences among cities themselves. However, public transport services in Hamburg, with a metropolitan area population of 2.4 million and a low population density, carry more passengers (558 million annually—see Table III) than the systems in Philadelphia (SEPTA 280 million, commuter railroads 32 million, and other carriers an estimated 60 million passengers per year), with a population of 4.5 million. The Chicago Transit Authority, with 450–500 million passengers per year, carries more than HHA in Hamburg, but the totals for all systems in the two regions appear comparable.

Organization of Public Transportation. Hamburger Hochbahn AG (HHA), founded in 1912 and merged with a number of companies in 1918, is the major transit carrier in Hamburg. HHA is operated as a private company, though the city owns a majority of its shares. It operates rapid transit (U-Bahn), streetcar, bus, and boat services in the city which carry 69 percent of the 560 million annual transit passengers.

Another 24 percent of passengers are carried by S-Bahn, a

system of urban and suburban electric and diesel (minor portion) railways of the German Federal Railways (Deutsche Bundesbahn—DB). The remainder of approximately 7 percent of transit passengers are carried by several companies which will be mentioned later.

Despite the fact that over 93 percent of the passengers are served by the two largest operators, it became obvious in planning a modern public transportation system for the region that physical improvements alone were not sufficient. Benefits from improved networks and services were often limited by the organizational deficiencies. Graduated fares with low transfer charges were used on most systems, but trips involving lines of different companies required two initial high-fare steps. As a result, suburban passengers, for example, preferred to be taken not to the nearest rapid transit station but to the one served by the feeder line company. Feeder routes were longer than necessary, and operators had to serve routes paralleling those of other companies, thus lowering patronage densities.

The higher costs, lower travel speed, and lower convenience to passengers than those that might have been offered without organizational barriers led to growing public pressure, supported by the press, for provision of a joint tariff. Aware of potential increases in operating efficiencies, the operators also showed an active interest in resolving the problem. After 1960 this was frequently discussed and analyzed, but the solution was not in sight. Coordination of public and private companies, different modes, and the key of revenue redistribution were particularly difficult problems to resolve.

The Transit Federation. The preparations of legal, organizational, economic, and technical aspects for integration of services took approximately five years. On November 29, 1965, the Hamburg Transit Federation (Hamburger Verkehrsverbund—HVV), a voluntary alliance of transit companies, was founded [5, 6, 7]. Its partners serve over 99 percent of all transit passengers in an area of about 50 × 60 kilometers defined as HVV Service Area (Figure 1). This area includes all of the City-State Hamburg and portions of the States of Schleswig-Holstein and Niedersachsen and has a population of 2.5 million.

The partners of the HVV comprise:

1. HHA—the principal transit company.

2. HADAG—company operating boats and ferries in the harbor, which had had a separate tariff agreement with HHA and remains its special partner within HVV.

3. DB—second largest operator with suburban railway lines and some bus services.

4–6. AKN, ANB, and EBO—three small railroads in the area to the north of Hamburg. ANB is entirely within HVV territory, the others operate also to points beyond it.

7–8. VHH and DBP—suburban and interurban bus companies. The former is relatively large; the latter, operated by the German Federal Post Office, has a very small role.

Table III gives a summary of the basic operating data of the HVV partners. A schematic presentation of the rail systems in Hamburg is given in Figure 2.

ORGANIZATIONAL, LEGAL, AND FINANCIAL ASPECTS OF HVV

The legal contracts provide that the HVV is to furnish for the region an effective and economical transit system independent of oplitical boundaries. It is to be neutral in its dealings with its constituent members.

Functions of HVV and Individual Partners. The operating partners have delegated to the HVV the following functions:

1. Planning of transit networks, routes, transfer points, etc., and the research activities necessary for this planning. A major planning objective is to promote the maximum use of the rail systems, and to connect surface routes in outlying areas to rail stations as much as possible.

2. Preparation of schedules and equipment assignments in a general way, including coordination of schedules between different operators.

3. Preparation and promulgation of the joint tariff which is applicable to the entire system, and revisions of this tariff. Calculation of operating costs and revenue redistribution for each operator according to a formula defined by the division-of-receipts contract.

4. Public relations, including publication of schedules.

5. Preparation of applications for aid under federal legislation.

The individual partners remain the legal carriers with the basic responsibility to furnish transportation, and with unchanged rela-

TABLE III—SELECTED DATA FOR THE HAMBURG TRANSIT FEDERATION SYSTEM—1968

Operating Agency	*Form of Transport*	*Route Length* Miles	*Route Length* percent of Total	*Space* Miles Operated* Miles	*Space* Miles Operated* percent of Total	*Passengers Carried* Mills.	*Passengers Carried* percent of Total	*HVV* Million DM	*Share of Revenues* percent of Total
HHA	Rapid Transit	51.5	4.9	3,831	29.5	174.6	31.3		
	Streetcars	61.8	5.9	1,007	7.8	68.5	12.3		
	Local Buses	289.2	27.6	1,207	9.3	124.7	22.3		
	Express Buses	125.4	11.9	328	2.5	14.1	2.5		
	Alster Boats	7.0	0.7	26	0.2	1.7	0.3		
	HHA Totals	534.9	51.0	6,399	49.3	383.6	68.7		
HADAG	Harbor Boats	53.8	5.1	223	1.7	10.3	1.9		
	HHA-HADAG Totals	588.7	56.1	6,622	51.0	393.9	70.6	159.33	65.89
DB	Suburban RR†	86.8	8.3	5,526	42.6	131.8	23.6		
	Suburban Buses	27.2	2.6	97	0.8	5.0	0.9		
	DB Totals	114.0	10.9	5,623	43.4	136.8	24.5	63.57	26.29
AKN	Suburban RR	18.6	1.8	105	0.8	2.2	0.4	1.46	0.60
ANB	Suburban RR	7.2	0.7	37	0.3	1.1	0.2	0.70	0.29
EBO	Suburban RR	6.2	0.6	20	0.2	0.7	0.1	0.40	0.16
VHH	Suburban Buses	281.4	26.8	543	4.2	22.8	4.1	15.90	6.57
DBP	Suburban Buses	32.6	3.1	18	0.1	0.6	0.1	0.44	0.18
HVV	System Totals	1,048.7	100.0	12,968	100.0	558.1	100.0	241.79	100.00

NOTES: * Spaces are rated capacity for seated plus standing passengers.
† Includes local passengers on long-distance trains with local tariff, but excludes long-distance passengers using commuter trains.

tionships to their passengers. They remain independent enterprises with the following functions:

1. Provision of the labor, equipment, and material required to operate the services assigned by the HVV.

2. Supervision of operations, preparation of detailed schedules, and handling of all other matters related to operation of a transit system.

3. Collection of fares, and transfer of these to the HVV.

4. Pursuit of other income sources (charter operations, advertising, etc.).

Those carriers whose systems cover an area beyond the HVV boundaries and/or include freight operations transfer only those services to the jurisdiction of the HVV, and are at liberty to conduct the remainder of their transportation business in any manner they wish.

Legal Arrangement [6, 7]. The HVV is a simple partnership, based on a series of contracts which were negotiated in 1965 between the HHA, the DB, and the VHH, and subsequently subscribed to by the other transit operators as they joined the Federation.

1. *The Framework Agreement* was signed between the DB and the government of the City-State of Hamburg, defining the HVV, its objectives and powers.

2. *The Federation Contract* is the instrument which actually created the HVV. It corresponds to the Framework Agreement, but was signed by the transit operators who joined the HVV.

3. *The Organization Contract* spells out the arrangements for organizing and operating the HVV itself.

4. *The Division-of-Receipts Contract* formalizes the method in which the pooled revenues of the transit operators are to be divided.

Organization of the HVV. The arrangements for the making and execution of policy of the HVV are, by American standards, quite complex, being organized into four separate bodies.

1. *The Assembly* consists of all the partner concerns of the HVV. It meets annually to approve the financial reports and adopt the budget for the following year, appoint auditors, and act on matters referred to it by the Council. Decisions are made by simple majority but require "yes" votes by the HHA and the DB. In practice, there have been no cases in which one group of partners found itself in opposition to another.

2. *The Council* has nine members, including the two members of the Presidium and one additional representative from each, the HHA and the DB, three delegates from the City-State of Hamburg (one of whom, the Minister for Commerce and Transportation, is the Chairman of the Council), and one representative each from the Federal Post Office and the State of Schleswig-Holstein. The membership of this Council can be reconstituted if important new partners join the HVV. It meets two or three times per year to determine issues which are deadlocked in the Presidium, and offers counsel on items of special economic importance.

3. *The Presidium* is a two-man body, consisting of the president of the Hamburg Region of the DB and the Chairman of the Board of the HHA—*ex officio*. It determines general policy and makes decisions on questions referred to it by the Directorate. It appoints the directors.

4. *The Directorate* consists of two officials, one nominated by the HHA and one by the DB. These directors have joint powers and responsibilities, which include the day-to-day operation of the HVV.

The Unified Tariff Agreement. One of the most important purposes of the HHV was the promulgation and administration of a unified tariff, so that transit passengers pay fare according to distance traveled, regardless of which company within the combined network they use. The tariff was therefore designed to permit free transferring between all routes and carriers, while at the same time producing sufficient revenues for all partners. Simplification of the tariff, to enable automation of ticket sales and passenger handling, was also desirable. The tariff includes single-trip fares, weekly, monthly, and annual tickets, student tickets, higher fares for express buses and first class of the suburban railways, and certain special fares.

Redistribution of Revenues. The revenues are redistributed among the partners by a formula which was carefully planned for the specific conditions in Hamburg. The "HVV formula" is based on the principle that each partner's profit-and-loss situation should remain approximately as it had been prior to joining the HVV. Thereby, profit-making agencies are assured continuation of their profit, while subsidized ones must continue to obtain financial assistance from whatever sources had provided such subsidies in the past. The

formula is renegotiated and changed infrequently, only when very special reasons exist (such as a change in labor productivity, taxes, etc.). Consequently, improvement in operating efficiency of a partner results in increased profits for him, since his expenses are reduced and revenues remain constant; recognition of efficiency is thus retained.

The formula for revenue redistribution provides that the share of total revenues due partner a is:

$$R_a = (R_t - C_h) \frac{\sum_{x=1}^{5} I_a A_{ax} c_x}{\sum_{a=1}^{n} I_a \sum_{x=1}^{5} A_{ax} c_x}$$

where:

R_t = Total revenue collected by the HVV;
C_h = Operating expenses of the HVV;
I_a = "Historic index" of partner a, i.e., his revenue-to-cost ratio in the year prior to joining the HVV;
A_{ax} = Quantities defining contribution of partner a to the operations of the system. The five quantities ($X = 1,..5$) entering computations reflect the effort of each partner through the following items: route miles of service, passenger seats in the vehicle fleet, locomotives (for DB's diesel operations only), seat-miles and train-miles of service provided;
c_x = Unit costs or relative weights of respective quantities A_x;
n = Number of partners in the HVV.

The actual financial results of each carrier may deviate from the revenue-to-cost "historic index" contained in the above formula, depending both on the total actual receipts of the HVV within the tariff period and on changes in the carrier's operating costs. However, at the start of a tariff period each carrier presumably performs according to his historic index. The percentage distribution of revenues due to each partner for 1968 is shown in the last column of Table III.

The operating expenses of the HVV in 1968 were equivalent to 1.24 percent of the total revenues from services by all partners. Since HVV covered 9 percent of its expenses by other revenues—primarily from publication of timetable books and advertising—each partner contributed 1.13 percent of his revenue share toward the operation of the Federation.

Results. Direct results of the creation of HVV have been quite beneficial. Joint tariff and coordination of services have resulted in the following changes:

1. Many passengers changed their travel routes: by selecting the fastest combination of lines, travel times were reduced in some cases by 25 to 50 percent.

2. Transfers between systems and lines increased substantially, indicating that passengers will accept the inconvenience of transferring if it leads to faster and cheaper travel.

3. For many trips, fares were reduced; however, in a few cases they had to be increased to be adjusted to the new tariff. Explanation to the public of causes for such changes and of overall benefits from the new system resulted in a rather smooth acceptance by the affected passengers.

4. Rationalization of services permitted operational savings, particularly on bus feeder routes, of up to 20 percent, as illustrated in Figure 3.

5. Counts at some rail stations (particularly on the DB railways) indicate increases of passengers of 25 to 110 percent after the introduction of joint tariff.

6. The percentage of passengers using weekly and monthly tickets increased from 42 to 54. Such a large share of prepaid tickets permits simplification of sales and decreases surface vehicle delays.

EVALUATION OF THE TRANSIT FEDERATION CONCEPT

In an overall evaluation we may conclude that the substitution of a coordinated system through the creation of a transit federation for individual disintegrated services in an urban area may bring a number of major benefits.

Transit passengers benefit from decreased travel times and cost, and increased convenience of service. The operators lose some of their functions, but remain independent and have increased operating efficiency. Both the operators and the city benefit from increased efficiency; in the Hamburg example this is reflected in better utilization of rail services and reduction of surface operations, decreasing street traffic.

Concentration of transit planning into one agency guarantees further system integration, facilitates coordination of planning with

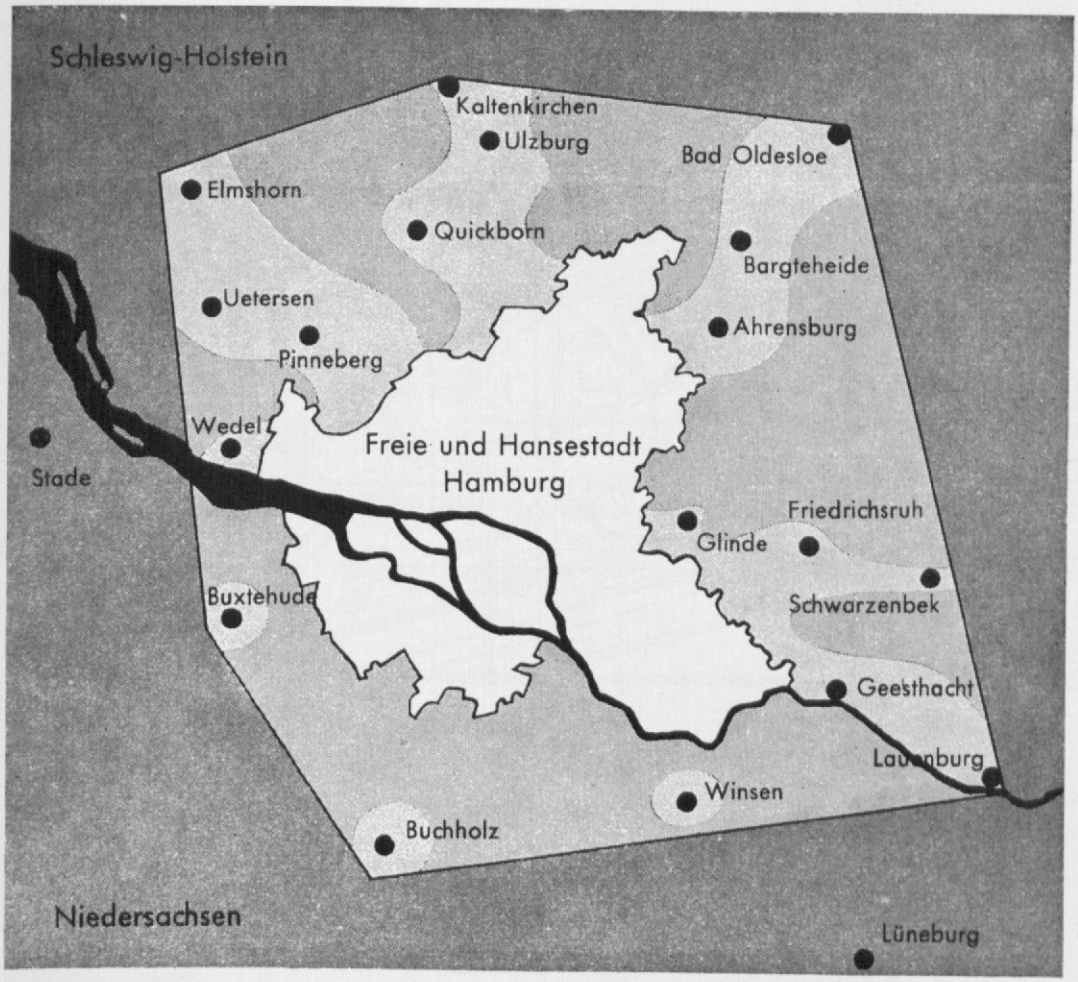
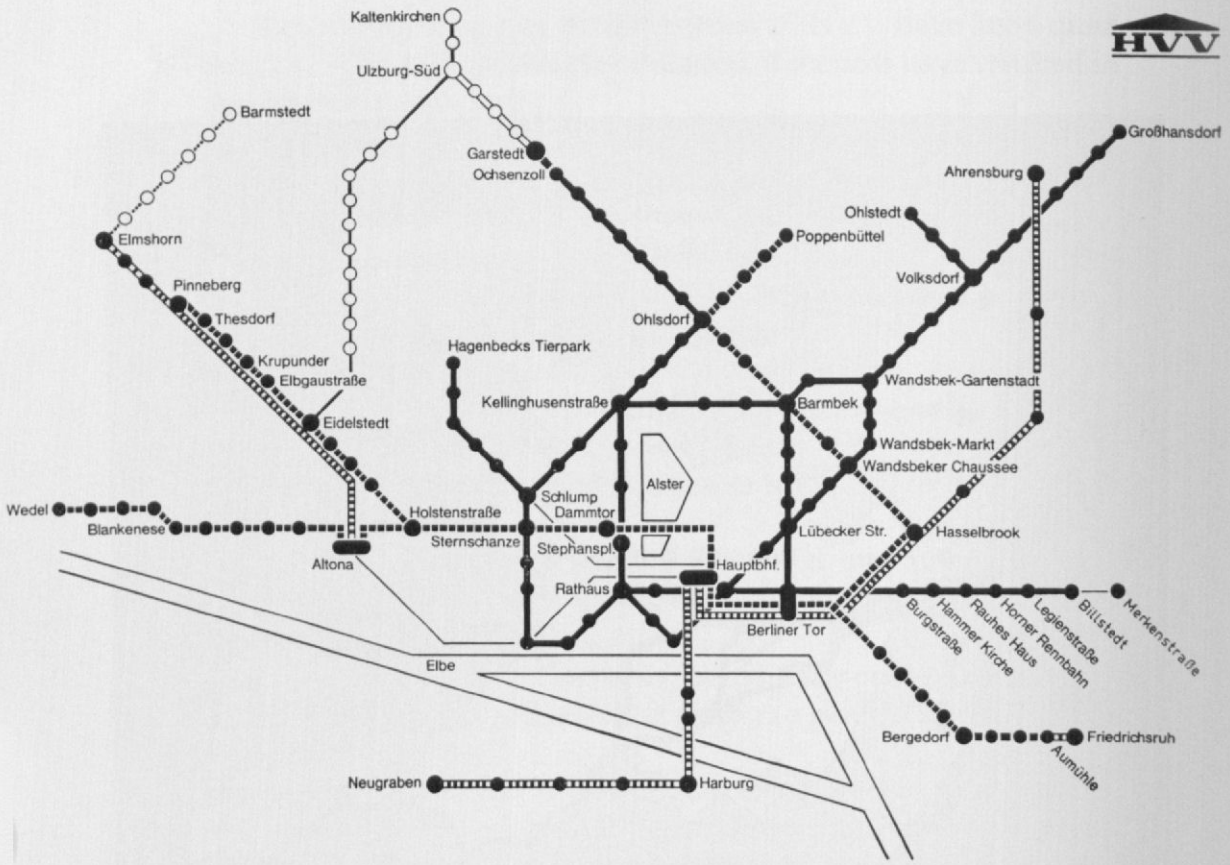


Figure 1. HVV service area, including City-State Hamburg and parts of Schleswig-Holstein and Niedersachsen



U-Bahn — Rapid transit operated by HHA

S-Bahn — Suburban railway, operated by DB (electrified-DC)

S-Bahn — (Diesel and electrified -AC)

AKN

ANB

EBO

U- and S-Bahn under construction

Figure 2. Network of rapid transit system and suburban railways in the Hamburg Transit Federation—HVV

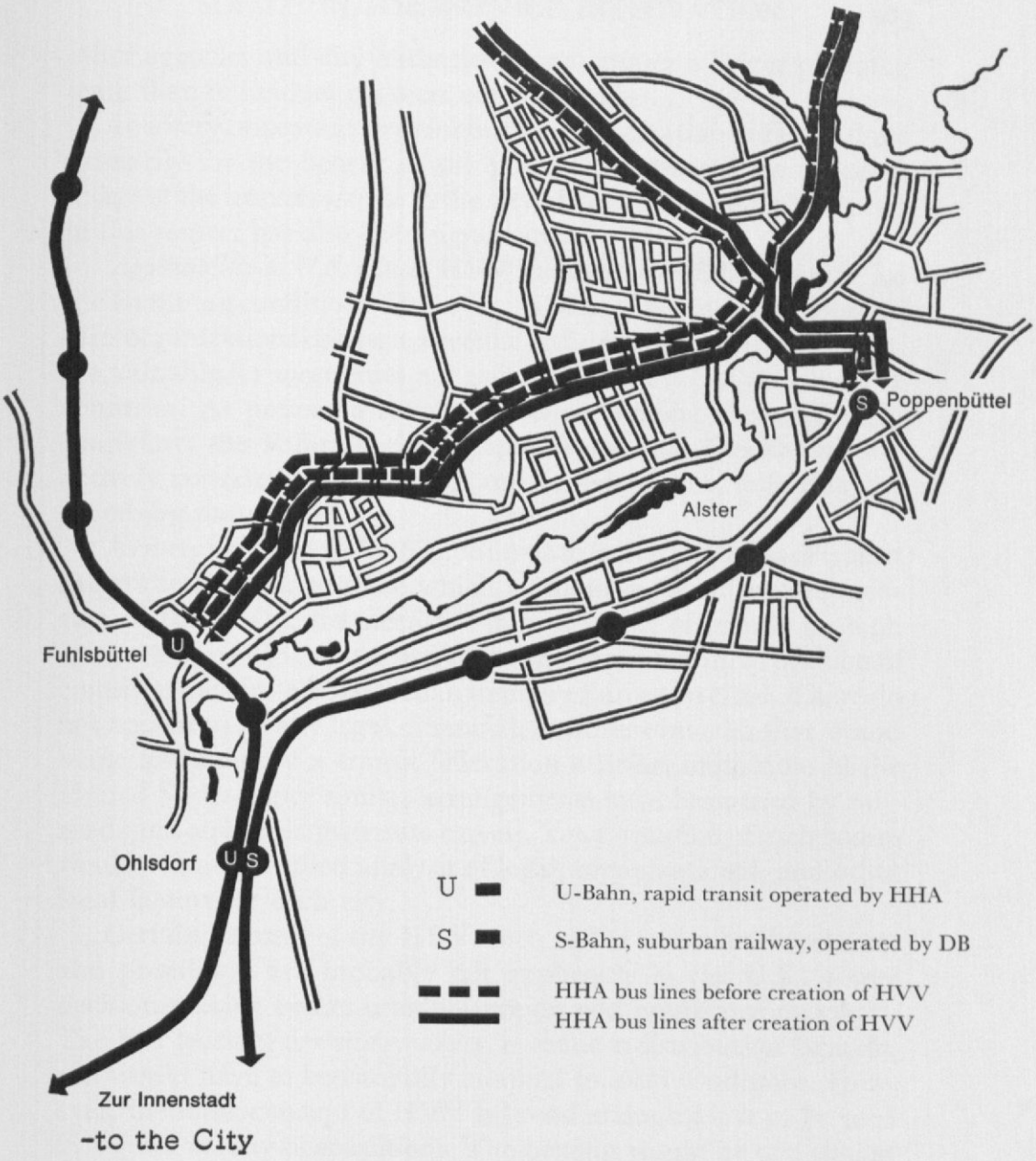


Figure 3. An example of rationalization of feeder services through systems integration

other agencies and city authorities, and creates a larger planning team than individual partners could provide.

It is very important to point out that the creation of HVV, done primarily for the benefit of the public, has created an excellent image of the transit systems in the city. The contribution of the press in this respect has also been significant.

Applicability to U.S. Cities. HVV has been carefully planned for the Hamburg conditions. However, its basic concept, some elements of its organizational pattern, revenue redistribution, principles, etc., are valuable for most cities not only in Germany but also in other countries. At present a number of cities, among them Munich, Frankfurt, the Ruhr Region, Copenhagen, and Stockholm, are actively considering creation of transit federations, following the Hamburg pattern [4].

As mentioned, cities in this country are facing problems of transit integration similar to those which Hamburg solved through creation of the HVV; the need for improvement of transit through integration is even greater due to the much more critical position of transit in the United States than in many European cities. There do not appear to be any legal, financial, or other obstacles that would make formation of a transit federation a priori impossible in the United States (since similar arrangements have been used by railroads and airlines in interstate travel). Yet, formation of such bodies would require detailed analysis of legal, organizational, and other local factors for each city.

Certain features of the HVV, such as the two-man directorate and presidium, are probably not applicable to the U.S., where decision-making bodies usually have an odd number of members. The four levels of decision-makers, revenue redistribution formula, etc. would have to be carefully adapted to local conditions. However, the basic concept of HVV is broad enough for it to be used in a great variety of conditions. The benefits would be of a similar nature to those experienced in Hamburg, distributed among the public, operators, and the city in general.

CONCLUSIONS

Ideally, all cities should have a unified public transportation system which a passenger finds easy to use for any trip, paying a

single fare regardless of the carriers used. The existing transit systems will not provide this until all services are integrated and coordinated. In many cities, the transit federation concept may be the best form of such integration since it provides the following advantages:

1. Total integration of services and tariff, i.e., an optimum service for the public.
2. Enhanced public image of transit.
3. Savings to the operating agencies.
4. Individual partners retain the interest in increased efficiency, even if subsidies are provided.
5. The organization is voluntary, partners remain basically independent agencies and retain their economic status.
6. Possibility of incorporating agencies different in size, ownership, and mode.

This brief analysis indicates that public officials and transit operators in a number of American cities should undertake detailed studies of the usefulness of the transit federation concept to integrate their urban public transportation systems. Both general studies directed toward the acceptability of this mechanism by existing institutions of policy-making and execution, and specific investigations of the feasibility within individual metropolitan areas seem warranted. Careful preparation of this kind should precede any attempts to introduce this new organization onto the American scene.

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